



Status of claims and support for claim changes

10/820,561

For Reissue of U.S. Pat. 6,373,868

October 8, 2009

In response to the Office Action dated July 15, 2009, applicant requests that the above application be amended as follows so as to provide a characterized identity to the thin gain region:

In step (4) of claim 10: After "said end mirrors" adding "so as to eliminate or minimize the spatial interference effect".

[CLAIMS]

This is the clean version of the set of the pending claims 10 -15 after the current amendment and will replace all prior versions, and listings, of claims in the application.

10. In a method for configuring a standing-wave cavity arrangement for solid-state lasers in obtaining stable single-mode operation, whereby overcoming the major difficulty with intracavity frequency conversions, typically in frequency doubling caused by the so-called "green problem", comprising the steps of

- (1) constructing a forming means for said cavity, including at least two end mirrors, wherein said cavity is a laser cavity without a beam expander;
- (2) constructing a pump head means placed within said cavity for lasing at a fundamental wavelength; comprising the steps of
 - A. selecting a solid-state laser medium means;
 - B. selecting a pump source means including laser diode bars to provide relevant pumping beams for pumping said laser medium means; and
 - C. producing a gain region within said laser medium means by said pump source means;

- (3) constructing a formation of wavelength selectivity with low insertion losses placed within said cavity, wherein the performance parameters of said formation are predetermined whereby to sufficiently and uniquely determine the laser's oscillating frequency and to force the laser to perform a stable single-mode or narrow band operation; and
- (4) creating said gain region within a narrow area along the optical axis of said cavity and immediately adjacent to one of said end mirrors so as to eliminate or minimize the spatial interference effect.

11. In the method of claim 10, said formation including

- (1) a first formation comprising a monochromatic polarizer means; and
- (2) a second formation comprising an etalon.

12. In the method of claim 11, further comprising the steps of

- (1) using a nonlinear crystal means arranged in an optimal condition including phase-matching for intracavity frequency conversion;
- (2) maintaining the bandwidth of said formation to be smaller than the laser longitudinal oscillating mode interval of said cavity, and its free spectral range is larger than the FWHM of lasing bandwidth of the gain medium;
- (3) building said monochromatic polarizer means up of a polarizer and said nonlinear crystal means; and
- (4) selecting said laser cavity from the group including 1) regular standing-wave cavities; 2) V-shaped standing-wave cavities; and 3) L-shaped standing-wave cavities.

13. In the method of claim 12, in order to protect the laser polarization at the fundamental wavelength from being altered or affected by the amount of

birefringence of said nonlinear crystal means and said laser medium means; further comprising the steps of

- (1) keeping said nonlinear crystal means to have a constant effective length to produce a phase retardation to be a half integral multiple of said fundamental wavelength; and
- (2) selecting said laser medium from the group including 1) nonbirefringent laser medium, and 2) birefringent laser medium having a constant effective length to produce a phase retardation to be a half integral multiple of said fundamental wavelength.

14. In the method of claim 12, further comprising the steps of

- (1) maintaining a constant cavity length whereby stabilizing operation frequency;
- (2) maintaining a constant temperature for said nonlinear crystal means whereby providing the best result for frequency conversion and minimizing cavity losses for the oscillating mode; and
- (3) constructing a wavelength tuning form for the alignment of said etalon transmission peak to said laser oscillation frequency.

15. In the method of claim 10, further selecting a nonlinear crystal means arranged in an optimal condition including phase-matching for intracavity frequency conversion, wherein said frequency conversion includes

- (1) second harmonic generation, wherein said nonlinear crystal means including KTP;
- (2) resonantly enhanced second harmonic generation, wherein
 - A. said nonlinear crystal means including KTP;
 - B. said formation is a regular etalon; and
 - C. said cavity arrangement is configured to resonate at said second harmonic frequency by a phase compensator means or cavity distance adjustor means

whereby largely enhancing the intensity of said second harmonic radiation and the conversion efficiency;

(3) third harmonic generation, wherein

said nonlinear crystal means is two nonlinear crystals positioned serially, in which the first crystal is set with type I phase-matching for doubling said fundamental radiation to produce the SHG, and the second crystal is set with type II phase-matching to mix said fundamental and second harmonic radiations so as to produce the THG;

(4) third harmonic generation with resonant harmonic generation, wherein

A. said nonlinear crystal means is two nonlinear crystals positioned serially, in which the first crystal is set with type I phase-matching for doubling said fundamental radiation to produce the SHG, and the second crystal is set with type II phase-matching to mix said fundamental and second harmonic radiations so as to produce the THG;

B. said formation is a regular etalon; and

C. said cavity arrangement is configured to resonate at said second harmonic frequency by a phase compensator means or cavity distance adjustor means whereby largely enhancing the intensity of said second harmonic radiation and the conversion efficiency;

(5) fourth harmonic generations, wherein

said nonlinear crystal means is three nonlinear crystals positioned serially, in which the first crystal is set with type I phase-matching for doubling said fundamental radiation to produce the SHG, the second crystal is set with type II phase-matching to mix said fundamental and second harmonic radiations for producing the THG, and the third crystal is set with type I phase-matching to mix said fundamental and third harmonic radiations so as to produce the FHG;

(6) fourth harmonic generation with resonant harmonic generation, wherein

- A. said nonlinear crystal means is two nonlinear crystals positioned serially, in which the first crystal is used for doubling said fundamental radiation to a second harmonic radiation, and the second crystal is for doubling said second harmonic radiation to a quadrupling harmonic radiation;
 - B. said formation is a regular etalon; and
 - C. said cavity arrangement is configured to resonate at said second harmonic frequency by a phase compensator means or cavity distance adjustor means whereby largely enhancing the intensity of said second harmonic radiation and the conversion efficiency;
- (7) frequency mixing, wherein
- A. further selecting an input radiation, including a resonantly enhanced input; and
 - B. said nonlinear crystal means mixes said fundamental and said input radiations to a mixing radiation; and
- (8) frequency mixing with resonant harmonic generation, wherein
- A. further selecting an input radiation;
 - B. said nonlinear crystal means is two nonlinear crystals positioned serially, in which the first crystal is used for doubling said fundamental radiation to produce the SHG, and the second crystal mixes said second harmonic and said input radiations to a mixing radiation;
 - C. said formation is a regular etalon; and
 - D. said cavity arrangement is configured to resonate at said second harmonic frequency by a phase compensator means or cavity distance adjustor means whereby largely enhancing the intensity of said second harmonic radiation and the conversion efficiency.